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REMARKS ON THE MOLLUSCAN GENERA HIPPAGUS, VERTICORDIA
AND PECCHIOIA.

BY ANGELO HEILPRIN.

The genus *Hippagus* was founded by Dr. Isaac Lea, in 1833 (Contributions to Geology, p. 72), for a small cordiform fossil shell from the Eocene deposits of Alabama, whose external appearance bore a somewhat general resemblance to *Isocardia*. Its affinities with that genus were at the time pointed out by that naturalist, who did not hesitate to class it in its immediate neighborhood, despite the great differences that were presented by the structure of the hinge in the two genera. To my knowledge, only two species, one other than the American, are as yet known to belong to this genus, the second one being a species from the Arrialoor Cretaceous group of Stripermatúr, India, discovered by the late C. Aemilius Oldham, and to which Stoliczka has applied the specific name of *Aemilianus* (Palæontologia Indica, Memoirs Geol. Surv. India, Cretaceous Fauna, iii, p. 262). In 1846 Mr. Searles Wood published in the seventh volume of Sowerby's Mineral Conchology, p. 67, his diagnosis of a new genus of fossil shell, for which he some years previously proposed the name *Verticordia*, and which was intended to embrace the only species known at the time, a fossil of the English crag (the *Cryptodon?* *Verticordia* of the "Catalogue of the Crag Mollusca," Annals and Magazine of Natural History, 1840, vi, p. 247). Almost simultaneously with the discovery of the Crag fossil, Philippi discovered in Calabria, South Italy, a very closely allied form, which, on the strength of the transcript of the characters of Lea's genus, as given by Bronn in the Lethæa Geognostica, he referred to *Hippagus* (sp. *acuticostatus*) (Enumeratio Molluscorum Siciliæ, 1844, ii, p. 42). Probably guided by the views of Philippi, Sowerby (*loc. cit.*) considered the new genus of Wood as untenable, and accordingly referred the English fossil in question likewise (although with doubt) to the genus *Hippagus*, imposing upon it the new specific name of *cardiiformis* (Min. Conch., vii, p. 68). Sowerby's example, singularly enough, is followed by Wood in his "Monograph of the Crag Mollusca" (Palæontographical Soc. Reports, ii, p. 149, 1851-3), who now renounces his genus, referring his species to

Hippagus, with the original specific name modified into *Verticordius*. Both the English and the Italian species have very little in common with Lea's *Hippagus*, which is edentulous, and belong properly to the genus *Verticordia* (*Trigonulina* of D'Orbigny), as reconstituted by conchologists.

Another singular fossil, long known to palæontologists as the *Chama ? arietina* of Brocchi (*Conchiologie Fossile Subapennina*, ii, p. 668), and which systematists generally referred to *Isocardia*, was thought by Sismonda (*Synopsis Method. Anim. Invert. Ped. Foss.*, p. 18; *fide* Hörnes, *Die fossilen Mollusken des Tertiär-Beckens von Wien*, ii, p. 169) to be referable to the genus *Hippagus* of Lea, but the dentiferous conformation of the hinge did not escape the attention of Meneghini, who, in 1851 (*Considerazioni sulla Geolog. Stratigr. della Toscana*, p. 180), constituted it into the genus *Pecchiolia*, restoring to it the original specific name of *argentea*, proposed, in 1797, by Mariti. Deshayes in (about?) 1860 (*Animaux sans Vertèbres*, Bassin de Paris, i, p. 809), described a minute fossil from the Paris basin under the name of *Hippagus Leanus*, which, in the prominence and recurved nature of its beaks, to some extent recalls the *Hippagus isocardioides* of Lea, but which differs in the presence, in each valve, of a cardinal tooth.

Deshayes was apparently doubtful as to the true generic position assigned to his species, inasmuch as he states that a more complete study of the American shell may lead to the separation of the two species into distinct genera. Having shown the correctness of Lea's figure and description, by the discovery of the allied Indian form, Stoliczka proposes (*Palæontologia Indica, Cretaceous Fauna*, iii, p. 225) the generic name of *Allopagus*, for the species from the Paris basin, which name it ought to retain. It will thus be seen that fossil shells belonging to no less than four distinct genera have been alternately referred to the American genus *Hippagus*.

All these agree, more or less, with each other in the closed and nacreous or semi-nacreous shell, recurved umbones, simple pallial impression, and the internal or subinternal arrangements of the ligaments. They differ in the dentiferous character of the hinge. The opinions of naturalists have been greatly at variance as to the position to be assigned to these genera in a natural classification, and, indeed, there appears to be no small difficulty in

arriving at a satisfactory conclusion as to their proper generic affinities. Philippi (*loc. cit.*, p. 41) classed his species under the *Cardiacea*, immediately after the genus *Isocardia*, a somewhat similar view being entertained by Oronzio Costa as to the position of his genus *Iphigenia* (= *Verticordia* ? Wood,¹ Seguenza, Jour. de Conchyliologie, 2d ser., iv, 1860, p. 290), which he placed in the proximity of the *Carditæ*. Seguenza states (*loc. cit.*) that the same views were entertained by Woodward in his "Manual of Mollusca," but that author seems to have overlooked the remark in the supplement to the work just mentioned (p. 471; and second edition, 1868, p. 472), whereby the genus is referred "undoubtedly" to the *Trigoniadæ*. The relationship with *Trigonia* is maintained by H. and A. Adams in their "Genera of Recent Mollusca," 1858, ii, p. 531), and by Deshayes in his valuable remarks on the family *Trigonea* Lamarck, and the genera *Verticordia* and *Hippagus* (Animaux sans Vertèbres, Bassin de Paris, i, pp. 805-10), although the last named naturalist in his review of the *Cardiacæa* (*loc. cit.*, p. 529), distinctly states that, for the time being, the genus *Pecchiolia* (misprinted *Petchiola*), which, on pages 806 and 810, he points out to be indisputably linked to *Verticordia* and *Hippagus*, will probably have to be referred to that family. According to Pecchioli (Revue et Magasin de Zoologie, 1852, p. 577) Meneghini, on establishing this genus, considered it as allied to *Diceras* of Lamarck, a view to some extent shared by Stoliczka, who, on proposing the family *Verticordiidæ* for the genera *Pecchiolia*, *Verticordia* and *Allopagus* (*loc. cit.*, p. 224), places the same in his order *Chamacea*. Lea's *Hippagus* is found a refuge among the *Ungulinidæ*, near *Scacchia*, the affinity with which, it must be confessed, appears to us as rather remote. Mr. Arthur Adams states in his observations on *Verticordia Japonica* (Annals and Magazine of Natural History, 3d series, ix, 1862, p. 224), that the animal has no relation to *Trigonia*, but, on the contrary, that "its position, judging both from the nature of the animal and the form of the

¹ I have been unable to gain access to Costa's work, and therefore cannot, from personal observation, pronounce upon the value of the genus *Iphigenia*; its identity with *Verticordia* is given upon the authority of Seguenza, but judging from this author's descriptions and figures of his two species of *Verticordia*, it would appear that he had confounded with that genus the genus *Pecchiolia*.

shell, would seem to be in the family Bucardiidæ, the animal differing from *Bucardia* (*Isocardia*) *cor* in the posterior [mantle] opening being fringed." The shell of this species, Mr. Adams further adds, is very different from that of *V. novemcostata* Adams and Reeve, from the China Sea, and very similar to the *V. granulata* of Seguenza, a Tertiary Sicilian fossil. Whether this last is a true *Verticordia* I am not in a position to judge, not having seen any specimens, but if the figures illustrating Seguenza's descriptions be correctly executed, they appear to represent a species of fossil very different from the *Verticordia cardiiformis* of Wood, the typical species of the genus *Verticordia*. The same may be said of Seguenza's figure of *V. acuticostata*, the species described by Philippi from the newer Tertiaries of Calabria, and which was considered by Wood, as identical with the species from the English Crag; the absence of a lunule (very prominent in *Verticordia*), the prominently recurved spiral umbones, and the great ventricosity of the shell, would seem to indicate a form much more nearly allied to *Pecchiolia*. If, however, as Seguenza states (*loc. cit.*, p. 293), "les valves des individus jeunes de cette espèce (d'un diamètre de 4 à 8 millimètres) sont minces, plus circulaires, moins renflées, et s'accordent parfaitement avec la figure de M. Philippi . . ." the question is settled as far as the identity of the Sicilian and Calabrian fossils is concerned, and a strong relationship between the genera *Verticordia* and *Pecchiolia* would be indicated; but it is at the same time very singular, and what makes it appear somewhat suspicious, that in the second species stated by Seguenza to belong to the genus *Verticordia*—*V. granulata*—there should be considerable differences in the character of the hinge, and, moreover, a deep lunule ("lunula profunda, cordata, ecostata, granulis carens") should be present. An indubitable species of *Verticordia*, the *V. Emmonsii* Conr., has been described from the Miocene deposits of North Carolina; the *V. Parisiensis* Deshayes, from the Paris basin, is at best but very doubtful. Although *Verticordia* and *Pecchiolia* may be very closely related forms (and their positions, everything considered, if the observations of Mr. Adams on *V. Japonica* be correct, would be about as near to *Isocardia* as to any other recent genus), there does not appear to be as yet sufficient evidence for uniting the two genera, as has been done by some conchologists. *V. granulata* and *V.*

acuticostata (et conseq., *V. cardiiformis* for Gwyn Jeffreys) are stated to be also living forms, both inhabiting the Japanese seas, and the former also the Mediterranean (Gwyn Jeffreys, "Mediterranean Mollusca," Annals and Mag. of Nat. Hist., 4th ser., vi, 1870, p. 73; "Japanese Marine Shells and Fishes," Journal Linnean Society, Zoology, xii, 1874, p. 101; Jour. Linn. Soc., xiv, 1879, p. 420); these species are all classed by Mr. Jeffreys as *Pecchiolia*, and placed among the *Corbulidæ*, and if the determinations have been correctly made, they go far to confirm the observations of Seguenza as to the variability of the genus *Verticordia* (and of its passage into *Pecchiolia*). But in addition to these forms of so-called *Pecchiolia*, we have the *P. [Lyonsiella] abyssicola* of M. Sars (Selsk. Forh., 1868, p. 257; G. O. Sars, "On some remarkable Forms of Animal Life," 1872, i, p. 25; Zoological Record, 1872, p. 166; G. O. Sars, Bidrag til Kundskaben om Norges Arktiske Fauna, 1878, p. 108, Pl. 20, fig. 5), an Arctic form certainly very distinct in the totality of its characters from at least some, if not all, of the preceding, but which is nevertheless admitted by Mr. Jeffreys into the genus *Pecchiolia*, and placed alongside two new species of his own description, *P. gibbosa* and *P. tornata* (Annals and Mag. Nat. Hist., 4th ser., xviii, 1876, p. 494). It certainly scarcely appears possible that three such very distinct forms (at least as they appear to me) as are represented by the *Chama arietina* of Brocchi (*Pecchiolia argentea* Meneg.), *Verticordia cardiiformis* of Wood, and *Lyonsiella abyssicola* of Sars, can belong to the same genus. The shell of this last is said to be thin, pellucid, inequivalve, and gaping posteriorly, whereas in *C. arietina* it is comparatively thick, equivalve, and completely closed. Nor does Sars' description of the animal of his species at all accord with Adams' observations on *Verticordia Japonica*. In the former the foot is said to be long, subcylindrical, and provided with a byssus, whereas in the latter it was found to be "small, triangular, and compressed." Again, in the former, the siphons are separate, subsessile, with the branchial not prominent (anal prominent), whereas in *V. Japonica* the "sessile siphonal orifices" are "close together, the branchial larger than the anal." The supposed pallial sinus stated to exist in *Chama arietina* by Pecchioli, was probably founded on an imperfection in the shell, since the pallial impression is stated to be simple by Hörnes, whose

description and figures are drawn from Italian specimens. The form of the Arctic shell recalls the *Verticordia Parisiensis* of Deshayes, which, however, differs in the presence of a cardinal hinge tooth; the pallial sinus represented in the figure (vol. i, Pl. x, fig. 12) is stated by the French conchologist to have been erroneously placed there by the artist, and, therefore, cannot be taken as a character separating it from *L. abyssicola*, in which the pallial impression is also non-sinuate ("hele, ikke bagtil indbugtede Kappe linie"). Finally, in the list of deep-sea mollusca dredged in the Bay of Biscay (Annals and Mag. Nat. Hist., October, 1880, p. 316), Mr. Gwyn Jeffreys revives the generic term *Verticordia* for a newly-discovered species, *V. insculpta*; is this species likewise to fall under *Pecchiolia*?

The similarity existing between Lea's genus *Hippagus* and *Crenella*, as exemplified by *C. glandula* Totten, a relation first pointed out by Jeffreys (Annals and Mag. Nat. Hist., 4th ser., vi, 1870, p. 73), is certainly very great, but yet there appear to be sufficient differences to warrant a generic separation. The umbones in *Hippagus* are much more prominently developed and spirally twisted, and, as far as I have been enabled to determine, there are no crenulations on the hinge-line; these, however, may have been eroded in the specimens (Lea's types in the collection of the Academy of Natural Sciences) examined. The structure of the shell appears to have been also considerably heavier than in *Crenella*. The *H. Aemilianus* of Stoliczka scarcely appears to differ from the *H. isocardioides*.

NOTE.—While preparing the preceding remarks on the genus *Verticordia* the author inadvertently overlooked the notice of that genus by Searles Wood, as contained in his "Monograph of the Eocene Mollusca" (Palæont. Soc. Reports, 1871). Reference is there made to the existence of an ossicle in the hinge, which led Mr. A. Adams to consider the genus as belonging to the *Anatinidæ*, and, therefore, as distantly removed from the *Bucardiidæ*, with which it had been previously placed by that author. This view is not concurred in by Mr. Wood, who, while in doubt as to its true relationship, places the genus in a family apart by itself—the *Verticordiidæ* (a family name first proposed by Stoliczka). The genus *Pecchiolia* is stated to be synonymous with *Verticordia*, but no grounds are given for so considering it.